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BOTANY.[1]

Thaxter's Studies of the Laboulbeniaceæ.—Mr. Thaxter has recently issued the fifth of his preliminary papers upon the *Laboulbeniaceæ* preparatory to the monograph of that group upon which he is engaged. In this paper he describes four new genera and fourteen new species, and gives a synopsis of the described species of the group. As it is indicated that the paper in question is to be the last of his preliminary papers, a few words as to his work upon the group and the effect which it seems likely to have may be timely.

Although the first representatives of the family were noticed as early as 1853, and received their first systematic treatment in 1869, it is only within a short time that the group has been thoroughly studied and any great number of forms discovered. In fact the great majority of the forms have been found in this country by Mr. Thaxter. In the first of his preliminary papers, in 1890, Mr. Thaxter states the total number of described species at fifteen. In the present paper he enumerates in the course of his synopsis twenty-three genera and one hundred and twenty-two species. The difference is mostly due to his researches.

The *Laboulbeniaceæ* are parasites on the outer surfaces of insects, principally of insects which live in or about the water. They grow either singly or in a thick fur, and are very minute, the largest not exceeding 1 mm., and most species being about 0.5 mm. in length. They have no mycelium and consist solely of a short stalk and a reproductive apparatus.

Reproduction in these fungi is of one sort only. Karsten was the first to describe it and he compared it to the sexual reproduction in the *Florideæ*. Peyritsch afterward made more exact and extensive observations and came to the conclusion that the supposed abscission of spermatia did not take place and that the sexual nature of the process was doubtful. Since these observations little or nothing has been published on the subject and for that reason the following statement made in the present article is of great interest:

"The writer's observations, based upon an examination of several thousand specimens illustrating more than one hundred species and more than twenty genera, appear to warrant the following conclusions."

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[1] Edited by Prof. C. E. Bessey, University of Nebraska, Lincoln, Nebraska.

"The *Laboulbeniaceæ*, while showing no signs of any non-sexual mode of reproduction are characterized by a well marked sexual type closely resembling that of the simpler *Florideæ*."

He goes on to give a summary of the process, which cannot well be abbreviated, and which is too long to be repeated in this place. Suffice it to say that he has found that "the trichogyne varies from a simple vescicular receptive prominence, or short filament, to a copiously branched and highly developed organ," that, however highly it may be developed, it always disappears immediately after fertilization; that the antherozoids are non-motile spherical or rod like masses of naked protoplasm, which originate in two genera exogenously from special branches and in other genera are produced endogenously in antheridia; that the antheridia are either single specialized cells or highly developed multicellular bodies, from which in either case the antherozoids are discharged through a terminal pore. It appears also that while the sexes are commonly present in the same individual, in some species they are completely separated on specialized individuals.

Although the observations, on which the foregoing conclusions are based, are not given, we may take it to be settled that the doubts as to the nature of the reproduction in these fungi raised by the observations of Peyritsch are set at rest. If so, several interesting questions arise.

There seems to be no doubt, as Mr. Thaxter remarked in a prior paper, that these fungi are real *Ascomycetes*. Indeed their title to a place in that group seems much better than that of some others which are included with little hesitation. If they are *Ascomycetes*, the ghost of the much vexed question of sexual reproduction in that group, which it was supposed had been effectually laid by Brefeld, must soon begin anew its visitations. And in any case, since the relationship of the *Laboulbeniaceæ* to the *Ascomycetes* as a whole must be close, even though they have no apparent relationship to any particular group of them, the whole scheme of the relationship of the *Ascomycetes* framed by Brefeld and his followers is placed on very shaky ground by the conclusions which Mr. Thaxter has announced.

After it had been shown that there was no sexual process in the *Ascomycetes*, the question remained, to what fruiting stage of the simpler fungi does the ascus stage of the *Ascomycetes* correspond. Brefeld has answered this by comparing it with the sporangium fructification of the *Mucoraceæ*. The ordinary *Ascomycetes*, called *Carpoasci*, he derives through *Thelobolus* from the carposporangic *Zygomycetes*, as *Mortierella*.

But the fact that in the *Laboulbeniaceæ* an ascus fructification is produced as the result of a sexual process throws grave doubt upon this theory, if it does not wholly overthrow it. It seems clear that the process of reproduction in these fungi, as outlined by Mr. Thaxter, indicates that the comparison of the ascus to the sporangium of the *Mucoraceæ* is wholly erroneous and that DeBary was right in considering it homologous to the sexual fructification of the *Phycomycetes*, whether or not he was wrong in believing it to be in many cases the result of a sexual process. It is perhaps not without significance that works like Von Tavel's Morphologie do not notice the *Laboulbeniaceæ* at all.

Another and still more interesting question will be presented when some one in the light of the development of the *Laboulbeniaceæ* ventures to reopen the question of the formation of the spore-fruit in the *Ascomycetes* and to question the conclusions of Brefeld. That the evidence must be reexamined seems to be clear if the conclusions announced by Mr. Thaxter are sustained by his observations. We have come to regard all accounts of sexual processes in fungi as doubtful since the writings of Brefeld have produced a school of sceptics on such points. If in a group which must be admitted to be immediately related to the *Ascomycetes*, if not a veritable member of them, which it evidently is, antheridia, antherozoids, and trichogynes—terms which the works on the morphology of the fungi have agreed to discard for the higher fungi—actually occur, we cannot rest content with any explanation of the formation of the sporocarp in the *Ascomycetes* which leaves any phenomenon apparently connected with those found in the *Laboulbeniaceæ* unaccounted for.

Mr. Thaxter's brief sketch suggests many coincidences which serve to convince one that the ghost of the DeBaryan theory as to the *Ascomycetes* will not down and that we may expect it to visit our slumbers nightly until we find some better means of reconciling the *Laboulbeniaceæ* with current theories as to the *Ascomycetes* than at present seems possible.

Mr. Thaxter's forthcoming monograph will be awaited eagerly by all who are in any degree interested in the morphology and biology of the fungi. It goes without saying that his previous work is a guaranty that our expectations will be amply realized.

Roscoe Pound.